**Raditya Fahritama – rkf5230@psu.edu**

**Scientific Review**

**Aim of the Research**

**Saraiva et al.** provide a technology approach and methodology for automatically and quickly classifying Pneumonia. The author chose and developed a classification of patient chest X-ray pictures that can be used to determine whether the patient has pneumonia or not. The classification stage is divided into two substages, the first of which is conducted by a Convolutional Neural Network and the second by a Multilayer Perceptron. The author believes that the method covered ensures comprehensive image recognition coverage.

**Puneet Gupta** believes that deep learning has the ability to achieve substantial characteristics in image classification tasks and to deliver medically better versions in image analysis. The author attempted to create optimum deep learning CNN models that can detect and categorize pneumonia conditions efficiently. The study consists of optimal CNN models as well as experimental examination of each model for the detection and classification of pneumonia illnesses. Deep Learning features are collected from images and used for pneumonia classification in x-rays. For accuracy comparison, the author employed both the transfer learning approach and CNN from scratch.

**Scientific Challenge**

***Limited dataset for Pneumonia Chest X-Ray***

Both of this research used the same dataset. That is Chest X-Ray of Pneumonia of pediatric patients aged one to five years. The image comes from Guangzhou Women and Children’s Medical Center. This can be a challenge to apply classification of adult’s chest x-ray images as the structure of the body in the image is not the same as children. And the number of images of pneumonia class are higher than the normal images. Balancing the dataset is necessary for the research and can lead to new challenge for the author.

***Determining which configurations of architecture that give best result for the model***

Both of this research created Convolutional Neural Network from scratch to compare the accuracy with other models. And because of this, the challenge for the author is determining which of the configurations of the model will create the best result for the accuracy. As building the neural network from scratch itself will be a challenge and significantly harder than using pre-trained models. Building neural network from scratch will take more time and resources to train to give the best result.

**Contribution and Difference from Related works**

Other works classify the Pneumonia with different model, different algorithms, and from different sources. **Saraiva et al.** utilize two learning models, Convolutional Neural Network and Multilayer Perceptron. The input of the test images separated by the k-fold algorithm is conducted in the phase of predicting test data, and the accuracy is recorded. The technique is performed 5 times, each time altering the test and training photos after calculating the k-fold. The author also employed the dropout approach in the fully connected layer of the Convolutional Neural Network to shorten training time and avoid overfitting. At each training iteration, a specific number of neurons from a layer are randomly removed and re-added to the next iteration.

**Puneet Gupta** used the Convolutional Neural Networks model and the Transfer Learning principle. Transfer Learning allows the model to save to the original parameter values of a previously trained model, resulting in an effective score without the use of intensive processing effort. The author employed the transfer learning models VGG16 and VGG19. In addition, the author used a customized Convolutional Neural Network with a Max-Pooling layer. By selecting only the maximum values from the kernel matrix, this layer reduced the values to half of their original value.

**Strength and Weakness of the research**

One of the notable weaknesses of the research is only using one transfer learning model for the classification. There are numerous of pre-trained models that are available for transfer learning. Like AlexNet, ResNet, SqueezeNet. The addition of number of models will increase the coverage of the research and will eventually give different perspective. And other weakness is that the research only using one type of dataset. That is pneumonia chest x-ray. This will be resulting in a narrow scope of classification. It will be beneficial to use other kind of dataset like radiographic thoracic images and other type of diseases like COVID or TBC to classify diseases.

Strong point of this research is that is the research using Cross-Validation for the metrics of evaluation. Cross-validation is an evaluation technique on the ability of generalization models, from a dataset, is widely used in problems where the object is the modeling and prediction. With this, it is possible to estimate how precise the model is, that is, its accuracy with data that it does not know. Another strong point is that the research utilizes transfer learning. This model will greatly reduce time of training for the model.

**Relevancy and Lessons Learned**

The research focused on how to diagnose Pneumonia based on Chest X-Ray Images and classify the Pneumonia type of it. The research covers issues that is similar for our proposed study. Not only by technical means, but also from methodology perspective. In our case, diagnose Pneumonia based on chest X-Ray images using transfer learning. And classifying Pneumonia type based on the images. We believe that we now have clear future plan on how to do the project, and what to expect for the challenges when doing this project, with these papers as guidance.

**Reference**

Puneet Gupta. (2021). Pneumonia detection using convolutionalneural networks. *January 2021*, *7*(01), 77–80. https://doi.org/10.46501/ijmtst070117

Saraiva, A., Santos, D., Costa, N., Sousa, J., Ferreira, N., Valente, A., & Soares, S. (2019). Models of learning to classify X-ray images for the detection of pneumonia using neural networks. *Proceedings of the 12th International Joint Conference on Biomedical Engineering Systems and Technologies*. https://doi.org/10.5220/0007346600760083